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# United States Department of Agriculture.

## DIVISION OF VEGETABLE PATHOLOGY.

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### TREATMENT FOR SOOTY MOLD OF THE ORANGE.

The very general and rapid spread of sooty mold, a fungous disease affecting the orange and other citrus fruits,<sup>1</sup> has made it desirable to secure, if possible, effective remedies for combating it. Numerous experiments in its treatment were conducted during 1894 at Gainesville, Citra, and Ocala, Fla., and the suggestions made in this circular are based upon the results of the work.

The sooty mold in its growth adheres closely to the surface of the leaves and fruit, covering them with a more or less continuous, dense, sooty-black membrane, which hinders the bright light from reaching the leaf surface proper. It also covers the stomata or breathing pores, and thus probably interferes considerably with the passage of gases, so that the process of assimilation is greatly hindered.

The effect of the disease on the tree and the fruit is very marked. The oranges are smaller than those normally produced, and are greatly retarded in ripening. They are, furthermore, insipid, less juicy, and of much poorer quality generally. The black, sooty-mold membrane, which spreads over the fruits, renders them unsightly and unsalable unless they are carefully washed. In severe cases the trees become stunted and cease to grow or to produce fruit.

The purpose of this circular is to suggest a method of treatment which has been found very satisfactory, omitting all details of the experiments and studies that have been made.

### RESIN WASH AN EFFECTIVE REMEDY.

The experiments made in treating sooty mold show conclusively that resin wash is a very effective and practical remedy. According to the formulas given, resin wash is prepared by using 70 per cent caustic soda and requires several hours' boiling. Recent experiments

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<sup>1</sup> The sooty mold of the orange is probably produced by several different species of the genus *Meliola*. The forms known as *Meliola penzigi* and *M. cameliae* appear to be the most common in Florida. In publications in this country the fungus has usually been referred to *Capnodium citri* and *Fumago salicina*.

conducted by this Division at Eustis, Fla., in the preparation of the resin wash show that it may be prepared in a few minutes, the strength of the preparation being the same as when the old formula is used. The wash is prepared as follows:

Resin.....	20 pounds
Caustic soda (98 per cent).....	4½ pounds
Fish oil (crude).....	3 pints
Water to make.....	15 gallons

Place the resin, caustic soda, and fish oil in a large kettle. Pour over them 13 gallons of water and boil until the resin is thoroughly dissolved, which requires from three to ten minutes after the materials begin to boil. While hot add enough water to make just 15 gallons. This may be most readily accomplished by taking a tight keg or other tall receptacle and measuring into it 15 gallons of water. Then plainly and permanently mark the height to which the 15 gallons come. After boiling, the hot solution may be poured directly into this measuring keg and sufficient water added to bring it up to the 15-gallon mark. This serves as a stock solution.

When this stock preparation cools, a fine, yellowish precipitate forms and settles to the bottom of the vessel. The preparation must therefore be thoroughly stirred each time before measuring out to dilute, as will be mentioned directly, so as to uniformly mix this precipitate with the clear, dark, amber-brown liquid, which forms by far the larger part of the stock preparation. An instrument like a churn dasher, without perforations, greatly facilitates rapid and thorough mixing. When desired for use take one part of the stock preparation to nine parts of water. If the wash be desired for immediate use the materials, after boiling and while still hot, may be poured directly into the spray tank and diluted with cold water up to 150 gallons. This requires the addition of about 135 gallons of water.

#### FLUID STOCK SOLUTION RESIN WASH.

If a perfectly fluid stock solution be preferred the wash may be prepared as follows: Place the same proportions of resin, caustic soda, and fish oil in the kettle and pour over them from 15 to 17 gallons of water. Boil until the resin is thoroughly dissolved, and then dilute with cold water, while the solution is still very hot, to exactly 21 gallons. To get this exact amount the barrel may be prepared and marked in the manner already described. This will form a clear, dark, amber-brown solution, which, at ordinary Florida temperatures, will remain perfectly fluid. For use dilute the whole formula to 150 gallons, or use in the proportions of one part of the stock solution to six parts of water.

#### COST OF THE WASH.

The cost of the wash prepared as here described and based on prices which have been quoted by New York and Jacksonville firms will be



less than one-third of a cent per gallon when diluted ready for application. When freight and labor in preparation are added the cost will probably not greatly exceed one-third of a cent per gallon. The materials for the wash may be procured from any wholesale drug firm. Resin is put up in barrels of about 275 pounds each, and varies in price from \$1 to \$1.50 per barrel. Crude resin answers the purpose as well as refined. The 98 per cent caustic soda, which is a white substance, similar in appearance to granulated sugar, we have used because of the greater ease in handling. It can be purchased by the barrel, of about 450 pounds, for from  $5\frac{1}{4}$  to  $5\frac{1}{2}$  cents per pound. In 100 or 200 pound packages it will cost about  $6\frac{1}{2}$  cents per pound. It is probably best for most growers to purchase rather small packages, as the material when exposed to the air absorbs moisture and is rendered unfit for use. A barrel or keg of caustic soda when once opened must be closed again if all be not desired for immediate use. The crude fish oil costs in New York or Philadelphia from 30 to 45 cents per gallon. At the rates above quoted the materials necessary for the foregoing formulas will cost about 45 cents for each 150 gallons of wash.

#### EFFECT OF RESIN WASH ON THE FRUIT.

Some orange growers have feared that the caustic soda of the resin wash would injure the fruit by rendering it insipid and tasteless. The wash has been extensively used in California for several years, and we are assured that no such effect has been noticed. During the summer of 1894 the wash was used in numerous groves in Florida, and as far as could be observed the fruit was as acid and pleasant to the taste as usual. It can be safely asserted that no injurious effect of this sort is produced. If the wash be used too strong the fruit may be burned, but this will not result unless it be used fully twice as strong as is here recommended.

#### WHEN AND HOW TO SPRAY.

Sooty mold commonly follows the attacks of certain honeydew-secreting insects, and this is an important item in its treatment. The fungus in Florida becomes serious only when accompanying the white fly or mealy wing (*Aleyrodes citri*), and the treatment of the disease given in this circular is based on its occurrence in this connection. In groves badly affected with sooty mold three successive applications would probably be an effective treatment, beginning about the middle of January and continuing about two weeks apart. A thorough treatment of this kind with the resin wash will, it is believed, nearly eradicate the disease.

During May and the first part of June is a second period when one may profitably spray should sooty mold be abundant. A third spraying period is during the latter part of August and the first part of September, but the work during this period is rendered rather uncertain

by the liability of rainfall. The wash is easily removed by rain and care must be taken not to spray while it is raining or when it is probable that there will be rain within two or three days.

In applying the wash the spray should be so directed as to reach all parts covered by the fungus. It is especially important to have the liquid reach the undersides of the leaves. Standing outside and merely directing the spray upon the tree only succeeds in wetting the upper surfaces of the leaves. The operator must get under the tree and spray upward and outward. In this way the lower surfaces of the leaves can best be reached. Spray from the interior of the tree first, starting here for personal comfort when the tree is dry. Put on most of the spray from within, spraying outward and gradually working around the trunk until all portions are reached; then go around the tree on the outside, spraying the exterior. This latter, however, need not be so thorough. The interior spraying is the most important. In spraying small trees the nozzle may be held within the foliage near the trunk so that the spray may be directed outward, spraying the opposite side without rendering it necessary for the operator to get under the tree.

Preparatory to beginning treatment for this disease, it is a good practice to trim up the trees within, around the trunk and main limbs. This leaves the greater part of the foliage near the exterior of the tree, and greatly facilitates spraying. Burn all the branches pruned off. Do not be sparing of the spray. A fourteen-year-old tree should have from 15 to 20 gallons at an application. Only a thorough and abundant spraying will succeed with this malady.

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Approved:

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